

# 1. Circular motion

平均加速度  $\bar{a} = \frac{v_2 - v_1}{t_2 - t_1}$

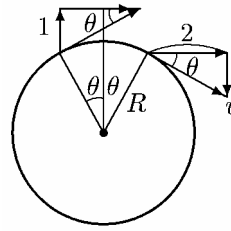
$v_2 - v_1 = 2v \sin \theta$

$t_2 - t_1 = 2R\theta / v$

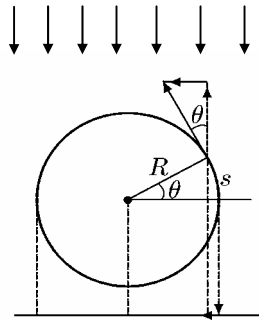
$\bar{a} = \frac{2v \sin \theta}{2R\theta / v} = \frac{v^2}{R} = \frac{\sin \theta}{\theta}$

向心加速度  $a = \lim_{\theta \rightarrow 0} \bar{a} = \frac{v^2}{R}$

hw1: prove  $\lim_{\theta \rightarrow 0} \frac{\sin \theta}{\theta} = 1$



simple harmonic oscillation



$x = R \cos \theta = R \cos(\omega t)$

$v_x = -v \sin \theta = -v_0 \sin(\omega t)$

$\theta = \omega t$        $\omega$  : 角频率(速度)

$v_0 = \omega R$        $\omega = \frac{d\theta}{dt}$

$= \frac{ds}{dt} = \frac{d}{dt}(R\theta) = R = \frac{d\theta}{dt} = \omega R$

$v_x = \frac{dx}{dt} = \frac{d}{dt} R \cos(\omega t) = R \frac{d}{dt} \cos(\omega t)$

$= -v_0 \sin(\omega t) = -\omega R \sin \omega t = R(-\omega \sin \omega t)$

$$\left\{ \begin{array}{l} \frac{d}{dt} \cos(\omega t) = -\omega \sin(\omega t) \\ \text{or } \theta = \omega t \\ \frac{d}{d(\omega t)} \cos(\omega t) = -\sin(\omega t) \Leftrightarrow \frac{d}{d\theta} \cos \theta = -\sin \theta \end{array} \right.$$